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Original Research Article

SUPERIOR BORDER VERSUS LATERAL BORDER MINIPLATE FIXATION IN MANAGEMENT OF MANDIBULAR ANGLE FRACTURE – A COMPARISON OF TWO TECHNIQUES.

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Abstract

Objective: The purpose of this study is to compare the outcome of two surgical approaches i.e. 1.intraoral superior border and 2. transbuccal lateral cortical plating for the management of angle of mandible fracture.

Methods: Cohort study conducted during December 2014 to December 2016. Total 20 patients were selected for this study. Patients were equally divided into transbuccal and transoral groups. SPSS Inc was used to compare the outcomes of the two surgical methods.

Results: Two patients showed sign of infection in which both showed dehiscence of incision and exposure of miniplates in Superior border fixation group. No patient showed a sign of infection in group 2. More time required for superior border fixation (mean- 63.9000 minutes) as compared to lateral border fixation (mean- 53.100 minutes). Neurosensory disturbance and the postoperative scar were higher in the 2nd group.

Conclusion: Transbuccal fixation technique is a superior fixation technique as compared to transoral fixation approach for the treatment of mandibular angle fractures.

Keywords: Angle of mandible, complications, fracture, transbuccal technique.

1. Introduction

Maxillofacial injuries generally occur in isolation or in association with other injuries [1-3]. Mandibular fracture has been reported to be the second most common fracture of the facial skeleton among maxillofacial injury, which is subsequent to its unique characteristics such as the mobility and limited bone support [4]. This is interesting to note that whenever the mandible is fractured, the angle is the most common site, accounting for 30% of all mandibular fracture in developing countries [5]. The angle fractures have been reported to have the highest rate of post-surgical complication among all the mandibular fractures [6-10]. A panoramic radiograph is the single most informative radiologic study used in diagnosing mandibular fractures [11]. Once the diagnosis of mandibular

angle fracture has been established ,the treatment options are (1) closed reduction or intraoral open reduction and non-rigid fixation (2) extra-oral open reduction and internal fixation with AO/ASIF reconstruction plate (3) intraoral open reduction and internal fixation using a solitary lag screw (4) intraoral open reduction and internal fixation using two 2 mm mini dynamic compression plates (5) intraoral open reduction and internal fixation using two 2.4 mm mandibular dynamic compression plates (6) intraoral open reduction and internal fixation using two non-compression miniplates (7) intraoral open reduction and internal fixation using a single non-compression miniplate (8) intraoral open reduction and internal fixation using a single malleable non-compression miniplate [12]. The principle of management of angle fracture is the perfect anatomical reduction and stable fixation [17]. The purpose of this study was to compare the outcome of two surgical approaches (1. intraoral superior border and 2.transbuccal lateral cortical plating) for the management of mandibular angle fractures, through open reduction and internal fixation.

2. Materials and Methods

2.1. *Study design and sample*:

This was a cohort study conducted on patients reporting/referred to the outpatient department of Oral and Maxillofacial Surgery, Dr. Z A Dental College, Aligarh Muslim University, Aligarh or admitted in the indoor after sustaining injuries during December 2014 to December 2016. A total of 20 patients of fractured mandibular angle were selected. To prevent the bias in patient's selection patients with even numbers were operated by the transbuccal approach and patients with an odd number were operated by the transoral approach. Although three surgeons were involved in the research project, the surgical technique was standardized as far as possible and all patients were given a standard perioperative and postoperative antibiotic regimen. Patients were asked to sign a consent for their willingness to participate in the study, if conscious and adult, or by his/her attendant/ guardian, if unconscious.

2.2. *Materials:*

The hardware used in the study were indigenously designed and manufactures by Loyal Mumbai. A 4 hole with gap titanium mini plate (2 mm thickness) were used in this study. Titanium screws (8 mm in length) were used to fix the plate.

2.3. *Inclusion and exclusion criteria:*

Adult patients with isolated angle fracture of the mandible were included in the study. Multiple fractures of mandibular angle, panfacial fracture, pregnant patient, medically compromise patients and patients with associated paraesthesia on the fractured side were excluded from the study.

2.4. *Variables:*

Time for completion of surgery (in minutes), intraoperative complications, post-operative occlusion, post-operative infection, dehiscence of incision not related to infection, exposure of miniplates, the incidence of tooth damage, neurosensory disturbance, removal of the plate, the incidence of plate failure and postoperative extraoral scar.

2.5. *Data analyses:*

All data were placed on to a designed database and with the help of the Statistical Package for the Social Sciences. The significance of differences in categorical data was assessed with the help of Fisher's exact test or the chi-square test, as appropriate, and those in continuous data with the non-parametric Mann–Whitney *U*-test.

2.6. *Surgical intervention:*

Antibiotic coverage with 1g ceftriaxone was given 1h preoperatively. All the procedures were performed under

general anesthesia. Operation site was prepared with povidone-iodine solution and draped. The local infiltration was administered with lignocaine 2% with adrenaline 1:80,000, after irrigating the oral cavity with povidone iodine.

A purely vestibular incision approximately 5 mm away from the attached gingiva was given with No. 15 blade on no 3 Bard Parker handle for superior border fixation group (Fig. 1) and vestibular and stab skin incision (Fig.2) to pierce the soft tissues overlying the posterior divisions of the mandible for lateral border fixation group. After sub-periosteal dissection, fractures were reduced with bone holding forceps. Fixation was done intraorally for superior border fixation group (Fig. 3) and with the help of transbuccal system for lateral border fixation group (Fig. 4). After copious irrigation with normal saline and povidone iodine intraoral site was closed with round body 3-0 silk and extraoral sites and extraoral stab skin incision was closed with reverse cutting 6-0 prolene. Postoperative intermaxillary fixation was not required in any patients. Postoperative antibiotic coverage with 1g ceftriaxone was given a BID for 5 days and sutures were removed on the 7th postoperative day. Patients were followed up to 6 weeks and evaluated immediately postoperatively, 1st week, 3rd week and 6th week. All the records were collected in a special designed case sheet.

3. Results

20 patients were divided into two groups based on the treatment modalities; 1. Intraoral superior border and 2.transbuccal lateral cortical plating, for the management of mandibular angle fractures, through open reduction and internal fixation. The mean age for group 1 patients was 29.70 years and for group 2 patients was 26.50 years. All patients in group 1 were male while 3 patients in group 2 were female and the rest were males. Group 1 contain 4 patients with the right angle of mandible fractures and 6 patients with the left angle of mandible fractures while Group 2 contain 5 patients with the right angle of mandible fractures and 5 patients with the left angle of mandible fractures. Time elapsed from start of the incision to closure of the wound was recorded and found that more time required for group 1(mean- 63.9000 minutes) as compared group 2 (mean- 53.100 minutes) and significant correlation between them was found with the P value of 0.047.

There was no intraoperative complication associated with both the groups. Every patient in the present study were reported with disturbed occlusion but after surgical intervention occlusion was intact for every patient in both the groups without the need for intermaxillary fixation. In group 1, two patients showed a sign of infection in which both showed dehiscence of incision and exposure of mini plates. In both patients infection resolved after prescribing proper antibiotics and regular dressing. No patient showed a sign of infection in group 2. Although the correlation between two groups in terms of infection (P- 0.211), dehiscence of incision (P-0.474) and exposure of miniplate (P-0.474) were not significant. No tooth damage was reported in both the groups. Six patients showed a neurosensory disturbance in the form of paresthesia and anesthesia in group 1 and three patients in group 2 without any statistically significant relation between them with a P value of 0.370. Not a single patient showed any incidence of plate failure with good bony healing. One patient needed plate removal in group 2 after 38 days due to pain. All the patients in the Lateral border fixation group showed an extraoral scar in the stab incision area for cannula insertion. Although scars were very minimal and reduced over a period of approximately six months to hardly

perceptible. There was a strong correlation between the two groups with a P value of 0.000. Table 1 shows the comparative results between two groups.

4. Discussion

Trauma is one of the leading cause of death worldwide causing considerable disfigurement, morbidity, mortality and burden on the resources and also the expenditure. There has been considerable development in assessment, resuscitation, and management of trauma in the last two decades which has improved overall outcomes, thus minimizing the impact of traumatic injuries on the society as a whole. The etiologies include vehicular accidents (43%), assaults (34%), occupational hazards (7%), fall (7%), sports-related injuries (4%) and other miscellaneous conditions (5%) [13]. Angle is the most common fracture accounting for 30% of total mandibular fracture associated with the highest rate of complication among mandibular fracture [5-10].

Meantime required for superior border fixation was 63.9 minutes and for the lateral border, fixation was 53.1 minutes. So in this study, more time required for superior border fixation group patients as compared to lateral border fixation group patients and this was statistically significant with the P value of 0.047. Our results differed from the study of Laverick et al [13] who concluded that the mean time required for superior border fixation was 55 minutes and for the lateral border, fixation was 60 minutes. No intraoperative complication was noted in both the groups related to plate and/or screws damage. Kenneth Wan et al. in 2012 [15] reported the incidence of the fractured plate as 2.7% for the transbuccal group and 1.08% for the transoral group which was statistically significant with the P value of .042.

Restoration of occlusion is one of the most important criteria for the management of maxillofacial fractures including the mandibular angle region. Every patient in the present study was reported with disturbed occlusion but after surgical intervention occlusion was intact for every patient in both the groups without the need for intermaxillary fixation. Sudesh Kumar et al. [16] also reported malocclusion in 1 patient in each transoral group (total patients- 35) and transbuccal group (total patients- 15).

Fractures in the maxillofacial region in the dentoalveolar region almost always considered as open fracture due to direct communication of fractured site with oral cavity through gingival sulcus and are heavily contaminated by oral bacteria [17]. Chances of infection also increase due to food debris accumulation caused by the arch bar and maxillomandibular fixation. In Superior border fixation group, two patients showed a sign of infection. In both patients infection resolved after prescribing proper antibiotics and regular dressing. No patient showed a sign of infection in Lateral border fixation group. Although the correlation between the two groups in terms of infection (P- 0.211) was not significant. Pattar et al. in 2013 [18] compared the post-operative infection in both groups and concluded that 2 patients (n- 12) showed post-operative infection in the transoral group as compared to 1 patient (n- 8) in the transbuccal group.

Only 2 patients in the transoral group showed wound dehiscence and no patient showed wound dehiscence in a transbuccal group with a P value of .474 which was not statistically significant. All the patients who showed wound dehiscence had the post-operative infection previously and later on dehiscence of wound occur. Sugar et al. in [19] reported wound dehiscence in 12 patients (n-56) in the transoral group as compared to only 8 patients (n- 84) in a transbuccal group with the odds ratio of 2.59.

This study showed 2 patients had the exposure of miniplate in the transoral group and no patient showed plate exposure in transbuccal group with the P value of .474 which denotes no significant difference between groups. All the patients who showed plate exposure also showed the postoperative infection and dehiscence of the wound. So the main reason behind wound dehiscence and exposure of miniplate were the post-operative infection which resolved after proper antibiotics administration and daily dressing of wound. Sugar et al. [19] reported the plate exposure in three reviews. In first review, 4% patients showed plate exposure in both transbuccal and transoral group while in the second review only 2% of patients showed plate exposure in the transbuccal group as compared to 4% patients in the transoral group. In the third review, he reported that plate exposure was seen in 5% of patients in the transbuccal group as compared to 7% of patients in the transoral group.

The plate and screws fixation have the capability of causing iatrogenic injuries to the roots of erupted teeth, and impacted wisdom teeth. Most commonly, damage to the tooth roots occurs if care is not taken during the application of drill bit. This should be less likely with lateral border fixation techniques because, in the angle region of the mandible, thick bone is present between the tooth and the cortex. Heibel H et al. [20] reported that the thickness of the cortical plate at the mandibular angle as 1.47 mm. The standard length of screws used in this study was 8mm while cutting tip of a standard transbuccal drill is longer than that and is not easily stopped during drilling before it damages deeper structures. So Louise Dunphy et al. in 2014 [21] reported in a technical note about the method for the correctly controlling the depth of drill hole during transbuccal osteosynthesis of mandibular angle and body fracture with the use of suction tubing catheter during ORIF which were placed 6 mm or 8 mm short of the end of the drill bit to avoid the damage of critical structure in the adjacent bone like inferior alveolar nerve or tooth bud. No patients showed tooth damage in this study. Post-operative clinical and radiological (OPG) examination were done to find out the signs and symptoms of tooth damage like pain, sensitivity to cold and hot, tooth mobility and tenderness.

Location of the fracture line and the position of the facial vessels and facial nerve guide the placement of extra-oral stab incision [22]. Murr AH et al. in 2002 [23] reported that despite the small stab incision for the placement of transbuccal cannula, chances of marginal mandibular nerve is still present which affect the function of salivary glands and aesthetic impairment due to an alteration in the balance of the musculature around the lower lip, preventing lateral and downward movement and lower lip inversion. Similarly, damage to the inferior alveolar nerve can also occur by the drill bit or screws which causes paraesthesia or anesthesia of the lower lip. Light touch sensation test with the help of wisp of cotton wool was used in this study to determine the neurosensory deficit. In this study, six patients showed a neurosensory disturbance in the form of paraesthesia and anesthesia of inferior alveolar nerve in lateral border fixation group and three patients in superior border fixation group without any statistically significant relation between them with a P value of 0.370. This study differs from the meta-analysis of Laverick et al [14] who reported that 60 patients (n-137) showed paraesthesia in the transoral group as compared to 51 patients (n-124) in a transbuccal group with the odds ratio of 1.12. No patient showed facial nerve palsy in this study which was consistency with the study of Kenneth Wan et al. [15], Sugar et

al. [19] and Purva Vijay Sinai Khandeparker et al. [24].

All the patients in both the groups were evaluated postoperatively for the plate failure in the form of a plate or screws fracture. Various factors should be considered while assessing the cause of plate fracture which includes material and design of plate, surgical factors like incomplete fracture reduction, improper plate adaptation, multiple plate bending and improper drilling technique. In this study, not a single patient showed any incidence of plate failure and all patients showed good bony healing. This study differs from the study of Sugar et al. [19] who reported that 20 patients (n-56) had plate failure in the transoral group as compared to 17 patients (n-84) in a transbuccal group with an odds ratio of 2.19. Plate removal post-operatively is controversial. Some believe that after the healing of the fracture, the plate should be removed routinely to prevent the foreign body reaction in the body [25]. However, some advocates that titanium plates are highly biocompatible and risk and cost of second surgery precluded the routine removal of miniplates [26]. The cause of plate removal may be a severe or recurrent infection at the fracture site, or if the plate/screws become loose or dislodged. In this study, one patient needed plate removal in Superior border fixation group after 38 days due to pain which was statistically not significant with the P value of 1.000. Pattar et al. [18] performed a prospective study on 30 patients who were operated under general anesthesia for the mandibular angle fracture. 10 patients were included into extraoral surgical approach group in which one patient required removal of the plate due to recurrent infection. 12 patients were included in transoral and 8 patients were included into the transbuccal group in which no patient required plate removal. Almost in all reviews presented in this studies, the transbuccal approach was considered as the better method as compared to transoral fixation technique. However, there is always some theoretical risk of damage to the facial nerve and an unfavourable facial scar in the transbuccal fixation technique [27-28]. All the patients in this study in Superior border fixation group showed an extraoral scar in the stab incision area for cannula insertion. Although scars were very minimal and reduced over a period of approximately six months to hardly perceptible. There was a strong correlation between the two groups with a P value of 0.000. Pattar et al. [18] also reported the similar findings and concluded that the scar due to stab incision was minimal and non-significant. However, the study of Purva Vijay Sinai Khandeparker et al. [24] differ from this study in the matter of extra-oral scar. They reported that scar evaluation in the transbuccal group at 6 months revealed 1 patient (3.3%) with a hypertrophic scar, 6 patients (20.0%) with barely visible scars, and 23 patients (76.7%) with invisible scars.

5. Conclusions

Transbuccal fixation technique is a superior fixation technique as compared to transoral fixation approach for the treatment of mandibular angle fractures. The technique is simple, less time consuming, miniplate at the neutral position as described by Champy et al. and require minimal plate bending for adaptation. In contrast, the transoral approach is more time consuming and bears more risks of complications. However transbuccal fixation technique requires additional armamentarium and technique sensitive in addition to extraoral scarring and chance of facial nerve injury.

6. Ethical Approval

This study was approved by Members of institutional ethics and research advisory committee, Faculty of Medicine, Aligarh Muslim University, Aligarh, UP, India.

7. Conflict of Interest

Authors have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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Table 1. Shows the comparative results between two groups.

SN	VARIABLES	GROUP 1 (n-10)	GROUP 2 (n-10)	p value
1	Time for completion of surgery (in minutes)	Mean- 63.9	Mean- 53.1	0.047
2	Intraoperative complications	0	0	
3	Post-operative occlusion,	0	0	
4	Post-operative infection,	30%	0%	0.211
5	Dehiscence of incision not related to infection	20%	0%	0.474
6	Exposure of miniplates	20%	0%	0.474
7	The incidence of tooth damage	0	0	
8	Neurosensory disturbance,	30%	60%	0.370
9	Removal of plate	10%	0%	F- 1.000
10	The incidence of plate failure	0	0	
11	Postoperative extraoral scar.	0%	100%	F- 0.000

n- Number of patients; p-value- Calculated probability; F- Fisher's exact test

10. FIGURE LEGENDS

Fig 1. Vestibular incision and subperiosteal dissection.

Fig 2. Vestibular incision, stab skin incision, subperiosteal dissection, and placement of transbuccal apparatus.

Fig 3. Plate fixation for the transoral system.

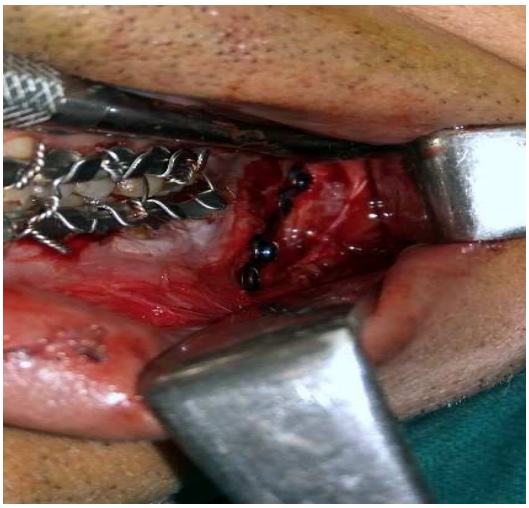

Fig 4. Plate fixation for the transbuccal system.